1. A system for assembling wing components, including wing spars and ribs between upper and lower wing panels, to manufacture a wing, comprising:

a machine tool;

a fixture for holding said lower wing panel and presenting said lower wing panel broadside to said machine tool;

a part program based on a dataset having wing assembly detail design information obtained directly from original digital engineering part definition records, including locations on the said lower wing panel of coordination features for positioning said spars adjacent forward and rear edges of said lower wing panel, said part program also including machine instructions for directing the movement of said machine tool to carry cutting tools to locations on said lower wing panel to perform machining operations needed to fasten said parts in locations specified by said original digital engineering part definition;

a machine controller for controlling motion of said machine tool in accordance with instructions contained in said part program and for automatically performing coordination probing to verify accuracy of said machine tool, fixture positioning, and positions of said components on said fixture.

2. A system for assembling wing components, as defined in claim 1, further comprising:

an index device mounted on said fixture at a known location to serve as a reference monument;

a probe end effector having an interconnect which can be gripped and centered by said machine tool and having a probe for sensing contact with said index device;

said machine tool having sensors for indicating positions of said probe end effector when said probe contacts said index device.

3. A system for assembling wing components as defined in claim 2, wherein said index device comprises:

a base member having a hole of precisely known dimensions at a precisely known location in said monument, said hole being accessible by a probe carried by said machine tool;

whereby said hole may be probed by said probe and the dimensions measured by said probe compared to the known dimensions and location of said hole to determine the accuracy of said machine tool.

4. A system for assembling wing components, as defined in claim 1, further comprising:

coordinate measuring means for sensing spatial locations of reference surfaces of said components and generating signals indicative of said spatial locations;

a communication channel for transmitting said signals to said machine controller for updating said part program with said spatial locations.

5. A system for assembling wing components as defined in claim 1, further comprising:

said fixture including a base member having a plurality of alignment pins for location of said wing panel on said fixture at a precisely accurate position;

a probe end effector having an interconnect which can be gripped and centered by said machine tool and having a probe for sensing contact with said pins;

whereby said pins may be probed by said probe and the location thereof measured by said probe, and said location may be compared to known locations of said pins to determine position accuracy of said fixture.

6. A method of manufacturing a wing, comprising:

positioning a wing panel on a fixture and holding said panel immobile on said fixture;

accurately placing critical coordination features in said wing panel and in two wing spars using a numerically controlled machine tool running on part programs incorporating digital wing product definition data from an engineering data authority, said critical coordination features being placed in said wing panel at locations having predetermined relationships with corresponding coordination features in said wing spars when said spars are accurately located in predetermined positions, spaced chord-wise from each other on said wing panel, specified by said digital wing product definition against said wing skin with said critical features in said spars and said wing skin positioned in said predetermined relation to each other; and

fastening said wing spars in fixed relation relative to said wing skin in said predetermined position.

7. A method of manufacturing a wing as defined in claim 6, further comprising:

probing reference surfaces on said wing panel after positioning said wing panel on said fixture with a coordinate measuring system to obtain accurate position data for said wing panel on said fixture; and

normalizing said wing part program to coincide with said accurate position of said wing panel on said fixture.

8. A method of manufacturing a wing as defined in claim 6, further comprising:

placing rib-to-spar critical coordination features in a plurality of wing ribs and in said spars using numerically controlled machine tools running on programs incorporating digital wing product definition from an engineering data authority, said ribs being accurately located in a predetermined position specified by said digital wing product definition relative to said wing spars when said rib-to-spar critical features in said ribs and said wing spars are positioned in a predetermined relation to each other; and

fastening said wing ribs to said wing spars in said predetermined position.

9. A method of manufacturing a wing as defined in claim 8, further comprising:

drilling a plurality of stringer-to-chord coordination holes in lower wing skin stringers attached to a lower wing skin and in a lower spar chord using a numerically controlled machine tool running on a program incorporating said digital wing product definition data from said engineering data authority, said lower wing skin being accurately located in a predetermined position specified by said digital wing product definition relative to said wing spars when said stringer-to-chord critical features in said ribs and said wing spars are positioned in a predetermined relation to each other; and

fastening said wing stringers and said wing spars together in said predetermined position.

10. A method of manufacturing a wing as defined in claim 9, further comprising:

locating a reference fixture spatially relative to a rear spar at a position corresponding to a predetermined position of a hinge axis specified by said digital wing product definition relative to said rear wing spar, using a numerically controlled machine tool running on a program incorporating said digital wing product definition data from said engineering data authority;

sliding a hinge barrel attached to a distal end of a hinge rib onto said fixture, and fixing a proximal end of said hinge rib to said rear spar at a position such that

said hinge axis remains at said predetermined hinge axis position, said hinge axis being accurately located in a predetermined position specified by said digital wing product definition relative to said wing

11. A method of manufacturing a wing as defined in claim 6, wherein:
said wing skin is positioned on said fixture in a horizontal orientation.

12. A method of manufacturing a wing as defined in claim 6, wherein:
one spar is located on said wing panel at one point using a coordination hole common to said one spar and said wing panel and is located angularly on said wing panel using an edge of said wing panel as another reference coordination fixture;
another spar is located on said wing panel using another coordination hole common to said other spar and said wing panel, and is located angularly on said wing panel using a rib fastened between said spars to determine the spacing between said spars at a position along said spars remote from said coordination holes.

13. A method of manufacturing a wing as defined in claim 6, wherein:
said wing panel is positioned on said fixture in a vertical orientation.

14. A method of manufacturing a wing as defined in claim 6, further comprising:
placing rib-to-spar critical coordination features in a plurality of in-spar ribs and in said spars using numerically controlled machine tools running on programs incorporating digital wing product definition from an engineering data authority, said ribs being accurately located in a predetermined position specified by said digital wing product definition relative to said wing spars when said rib-to-spar critical features in said ribs and said wing spars are positioned in a predetermined relation to each other.

15. A method of making an airplane wing with upper and lower outer mold lines corresponding closely with design specifications for said wing, said wing having upper and lower wing skin panels, each with inner and outer contour surfaces, comprising:
positioning a plurality of headers on a bed of a machine tool, said headers when positioned on said machine tool bed having upper contours coinciding closely with the desired lower outer mold line of said wing;

indexing said lower wing skin panel on said headers and supporting said lower wing panel thereon with the lower outside surface thereof coinciding closely with said desired outside contour;

machining coordination features in said lower wing panel on said machine tool using digital wing product definition data from an engineering authority for said wing to program said machine tool as to the location of said coordination features;

applying sealant to outer surfaces of lower flanges of front and rear wing spars and accurately positioning said front wing spar on said lower wing panel adjacent a front edge thereof, and positioning said rear wing spar on said lower wing panel adjacent a rear edge thereof using coordination features on said spars and said coordination features on said lower wing panel;

fastening one of said spars in a fixed location to said wing panel adjacent one edge thereof, and fastening the other of said spars at one end thereof adjacent the other edge of said wing panel;

drilling coordination holes in the end portions of a multiplicity of in-spar ribs and corresponding coordination holes in a multiplicity of rib posts attached to said spars in positions corresponding to the desired positions of said in-spar ribs in said wing, said coordination holes, said rib post coordination holes and said rib end coordination holes having been accurately drilled by a machine tool programmed with hole location data from said digital wing product definition data from said engineering authority for said wing, said rib post coordination holes and said rib end coordination holes being positioned to position shear tie surface and stringer contact surfaces on said in-spar ribs at a position such that said wing panel outer contour surface will correspond closely with the desired wing contour when said wing panel is fastened to said in-spar ribs;

fastening said in-spar ribs to said rib posts at locations determined by registry of said rib post coordination holes and said rib end coordination holes;

fastening said front and rear spars to said lower wing panel by drilling holes through said wing panel and through said spar flanges, inserting fasteners through said holes, and securing said fasteners in said holes; and

fastening said lower wing panel to said ribs and to said spars to produce a lower wing box assembly; and

positioning an upper wing panel over said lower wing box assembly and fastening said upper wing panel to said ribs and said spars.

16. A method of making a wing as defined in claim 15, further comprising:

fastening said wing panel to said shear ties by directing said machine tool to a position vertically aligned with a flange on said shear tie;

drilling a hole through said wing panel and said shear tie flange with a drill bit in said machine tool; and

inserting and securing a fastener in said hole;

whereby said directing step includes downloading data from said digital wing product definition to a controller for said machine tool and using said data to inform said machine tool controller of said fastener hole locations.

17. A method of making a wing as defined in claim 15, wherein:

fastening said rib chords to said rib web with interference fasteners;

at least one of said rib-to-spar coordination holes are drilled after said rib chords are fastened to said rib web; whereby said rib web is distorted by interference fasteners before the chord-wise distance between said front and rear spars is set by said rib-to-spar coordination holes on said one end of said rib is drilled.

18. A method of making a wing as defined in claim 15, further comprising:

machining said headers with said machine tool to produce said upper contours using data from said digital wing product definition data from said engineering authority for said wing to program a machine tool controller that controls operation of said machine tool.

19. A method of making a wing as defined in claim 15, further comprising:

attaching aileron hinge ribs to said rear spar by positioning a pin held by said machine tool at a location determined by said digital wing product definition data from said engineering authority for said wing on an aileron hinge axis;

sliding a hinge bushing on a distal end of said aileron hinge rib onto said pin to accurately position said distal end of said hinge rib at its designated position;

fastening said hinge rib to said rear spar at a position to maintain said position of said distal end of said rib after said pin is removed; and

removing said pin from said hinge bushing.

20. A method of assembling a wing in accordance with a digital engineering product definition of said wing and within tolerances specified in said definition, comprising:

machining coordination features in major wing components, including a wing spar, a plurality of wing ribs, and a wing skin, using a numerically controlled machine tool running on a program incorporating said digital wing product definition from an ultimate engineering data authority, said coordination features being accurately located in predetermined positions on said components specified by said digital wing product definition such that said components are positioned at positions specified by said digital wing product definition relative to each other when corresponding ones of said coordination features are aligned with each other;

supporting one of said components on a fixture; and

locating the other of said components relative to said one component in a configuration determined by said coordination features to produce a wing in accordance with said digital engineering product definition of said wing and within tolerances specified in said definition.

21. A method of assembling a wing as defined in claim 20, wherein:

said one component is a wing spar, and said fixture supports said wing spar in a horizontal position, with a waterline plane oriented vertically.

22. A method of assembling a wing as defined in claim 20, wherein:

said one component is a wing panel, and said fixture has upwardly facing surfaces supporting said wing panel in a horizontal position.

23. A method of assembling a wing as defined in claim 22, wherein:

said upwardly facing surfaces of said fixture were machined to a profile defined in said digital engineering wing product definition with said numerically controlled machine tool.

24. A method of assembling a wing as defined in claim 20, further comprising:

checking the accuracy of said machine tool by probing a monument of known dimensions and location with a probe carried by said machine tool to compare the predicted dimensions and location of said monument with the dimensions and location as actually measured by said machine tool.

25. A method of assembling a wing as defined in claim 20, wherein:

said one component is a wing spar, and said fixture supports said wing spar in a horizontal position, with a waterline plane oriented horizontally.

26. A method for manufacturing a product, comprising an assembly of detail parts, to correspond within designated tolerances of a digital product model in a digital product definition, comprising:

generating a digital definition, including a digital model, of each of said detail parts, said detail parts digital models, when assembled digitally, corresponding to said digital product model;

manufacturing said detail parts in accordance with said detail part definitions;

assembling said detail parts into said product by:

a. placing a first major subassembly of said detail parts on a support surface of a fixture, oriented in a predetermined spatial orientation on said support surface;

b. measuring the actual position of said first major subassembly to determine the exact actual position thereof on said fixture;

c. normalizing the orientation of said digital model to correspond to said actual position of said first major subassembly on said support surface;

d. positioning the other parts relative to said first major subassembly in accordance with said digital model and fastening said other parts into said assembly to produce said product.

27. A method as defined in claim 26, further comprising:

trimming said support surface with a trimming tool under control of a CNC controller to an accurate profile defined in said digital product definition, using data from said digital product definition to program said controller, before placing said first major subassembly on said support surface.

28. A method as defined in claim 26, wherein:

said positioning of said other parts relative to said first major subassembly includes machining coordinating features in said parts and placing said parts with said coordinating features at a predetermined relationship to each other to position them accurately relative to each other;

said machining step includes programming a CNC controller of an accurate machine tool to direct a cutter with precise accuracy to positions, designed as coordinating features in said digital product definition and on said parts, to cut said coordinating features.

29. A method as defined in claim 26, wherein:

said fastening includes

a) drilling fastener holes through abutting portions of said parts; and

b) inserting interference fasteners in said holes;

whereby elimination of dimensional variations due to accumulated distortion produced by said fastener insertion is facilitated by scheduling said fastener insertion in an assembly sequence prior to a final trimming operations.

30. A method as defined in claim 26, wherein said drilling includes:

transmitting said digital product definition to a CNC controller of a machine tool;

driving a drilling head on said machine tool accurately to fastener locations specified in said digital product definition;

pressing said parts together to prevent burrs from intruding into an interface between said parts at said fastener locations; and

drilling said holes.

31. A method as defined in claim 26, further comprising:

assigning a level of priority to each of said parts based in part on the importance of dimensional accuracy of said parts to the dimensional accuracy of said assembly; and

building said parts to a dimensional accuracy commensurate with said level of priority; and

maintaining said dimensional accuracy of said parts for only so long as said dimensional accuracy is important to said dimensional accuracy of said assembly.

32. A method for accurately fastening an aileron hinge rib to a rear spar of an airplane wing, comprising:

positioning a positioning pin accurately in space to the rear of a rear spar at a position determined by a digital wing product definition as the desired position for a hinge bushing in a distal end of said aileron hinge rib;

sliding said hinge bushing onto said locating pin; and

attaching a proximal end of said aileron hinge rib to said rear spar at a position that maintains said hinge bushing in said distal end of said rib in said desired position.

33. A method as defined in claim 32, wherein said locating step includes:

mounting said positioning pin in a machine tool; and

instructing a machine controller with instructions based on said digital wing product definition to move said machine tool to a position that will position said mounting pin accurately at said desired position.

34. A method as defined in claim 33,further comprising:

removing said mounting pin from said hinge bushing after said proximal end of said rib is attached to said spar.

35. A method of assembling an airplane wing, comprising:

accurately attaching an airplane wing spar on an airplane wing panel, including the steps of:

a) machining a first coordination feature in said airplane wing spar and a second coordinating feature in said airplane wing panel which, when positioned with a predetermined relationship to said first coordinating feature, locates one point on said wing panel accurately with respect to said wing spar;

b) pinning said spar to said wing panel through said coordination holes; and

c) positioning one edge of said wing spar with respect to an edge of said wing panel by placing an accurately machined gauge relative to said edges and contacting said edges against said gauge to rotate said spar about said pin to uniquely position said spar angularly with respect to said wing panel.

36. A method of assembling an airplane wing as defined in claim 35, further comprising:

accurately attaching a second airplane wing spar on said airplane wing panel, including the steps of:

a) machining a third coordination hole in said airplane wing spar and a fourth coordination hole in said airplane wing panel which, when aligned with said third coordination hole, locates one point of said second wing spar accurately on said wing panel at a predetermined position;

b) pinning said second spar to said wing panel through said third and fourth coordination holes; and

c) positioning one edge of said second wing spar with respect to an edge of said first spar by placing an airplane rib between said spars and aligning coordination holes in the ends of said rib with corresponding coordination holes in rib post fastened to said spars to uniquely position said second spar angularly with respect to said first wing spar.

37. A method of assembling an airplane wing as defined in claim 36, wherein:

said machining steps include loading a program in a CNC controller of an accurate machine tool, said program having data obtained from a digital wing definition identifying locations, sizes and shapes of said coordination features on said spar and said wing panel; and;

running said program in said controller to direct a cutter with precise accuracy to positions on said wing spar and said wing panel, designed as coordination features in said digital wing definition, to cut said coordination features in said spar and said panel.

38. A method of assembling an airplane wing as defined in claim 35, further comprising:

applying sealant to a lower faying surface of a lower chord of said wing spar that contacts said lower wing panel;

clamping said wing spar to said lower wing panel in said unique position to produce pressure in an interface between said lower surface of said chord and said wing panel;

drilling fastener holes, while maintaining said spar unmoved from said unique position, through a flange of said chord and said wing panel free of burrs or chips in said interface by virtue of said interfacial pressure; and

inserting and securing fasteners in said fastener holes, while maintaining said spar unmoved from said unique position, to secure said spar in said unique position.

39. A method of assembling an airplane wing as defined in claim 35, wherein:

said machining step includes running a program in a CNC controller of an accurate machine tool to direct a cutter with precise accuracy to positions on said wing spar and said wing panel, designed as coordination features in a digital wing definition, to cut said coordination features in said spar and said panel, said program incorporating data from said digital wing definition.

40. A method of assembling an airplane wing as defined in claim 39, wherein:

said first coordination feature in said airplane wing spar and said second coordination feature in said airplane wing panel are holes drilled by said machine tool, said first coordination feature being located at an inboard end of said spar; and

a plurality of said gauges are spaced along said spar to position a plurality of points on said spar with respect to said wing panel edge.

41. A method of assembling an airplane wing as defined in claim 35, further comprising:

clamping said spar and said wing panel together with a clamp attached to said gauge to hold said spar to said wing panel in said unique position established by said gauge.

42. An edge locator device for positioning a spar at a certain position lengthwise therealong a desired distance from an edge of a wing panel, comprising:

a body having a shoulder defined in part by a first upright surface, and a second upright surface spaced on said body a certain distance from said first upright surface;

said certain distance being equal to said desired distance;

whereby said body is positioned between said spar and said edge of said wing panel, with said first upright surface engaged with said spar, and said second upright surface engaged with said edge of said wing panel to position said spar said desired distance from said edge of said wing panel at said certain position lengthwise along said spar.

43. An edge locator device as defined in claim 42, further comprising:

an opening for receiving a temporary fastener through said first upright surface, for fastening said body to said spar;

whereby said body is temporarily fastened to said spar with said temporary fastener, and said spar is positioned on said wing panel with said second upright surface engaged with said edge of said wing panel to locate said spar at said desired position.

44. An edge locator device as defined in claim 42, further comprising:

a clamp attached to said body having a clamp arm positioned to grip said wing panel when said second upright surface is engaged with said edge of said wing panel and said spar is located at said desired position.

45. An edge locator device as defined in claim 43, further comprising:

a standoff on said body for positioning lowermost portions of said first upright surface spaced above said wing panel.

46. A determinantly assembled airplane wingbox, comprising:

two wing spars accurately located at certain positions between upper and lower wing panels, each wing spar having an elongated upright web with upper and lower flanges, said flanges each having installation coordination features machined therein;

said wing spar flanges fastened to said upper and lower wing panels at said certain positions thereon and within engineering tolerances specified by a digital wing product definition established by an ultimate engineering authority for said wing design, said installation coordination features in said flanges accurately locating said spars within said engineering tolerances relative to said wing panels by registration of said coordination features in said spar flanges with corresponding coordination features in said wing panels;

said wing panel coordination features machined therein using a cutting bit in a machine tool under control of a controller programmed with a program incorporating data from said digital wing product definition, said digital wing product definition specifying locations of said wing panel coordination features in said wing panel for positioning said wing spars at said certain positions relative to said wing panels when said wing panel coordination features are in registry with corresponding coordination features in said spar flanges.

47. A determinantly assembled airplane wingbox as defined in claim 46, wherein:

said coordination features in said spar flanges include at least one coordination hole drilled adjacent one end of said spar, and said coordination features in said wing panels include corresponding coordination holes drilled in said wing panels by a drill bit in said machine tool.

48. A determinantly assembled airplane wingbox as defined in claim 47, wherein:

said coordination features in said spar flanges include an edge surface on said flanges extending alongside and in spaced relationship to edge surfaces of said wing panels, which constitute corresponding coordination features on said wing panels.

49. A determinantly assembled airplane wingbox as defined in claim 47, further comprising:

in-spar ribs fastened at opposite ends thereof between said wing spars to rib posts attached to said spars;

said in-spar ribs having upper and lower flanges, said upper and lower flanges attached intermediate opposite ends thereof to said wing panels.

50. A determinantly assembled airplane wingbox as defined in claim 49, wherein:

said in-spar ribs are attached to said wing panels at preestablished positions by fasteners extending through fastener holes drilled through said upper and lower flanges of said in-spar ribs and through said wing panel, said fastener holes coinciding with coordination holes predrilled through said upper and lower flanges of said in-spar ribs and said wing panels and aligned with one another to position said ribs relative to said wing panel at said preestablished positions;

said preestablished positions existing in a digital model of said wing residing in said digital wing product definition, said fastener holes drilled by a machine tool under control of said controller programmed with a program incorporating said digital wing product definition data that specifies locations of wing-panel-to-rib-flange fastener holes for securing said in-spar ribs to said wing panels at positions specified in said digital wing product definition and achieved in said wingbox when said coordination holes in said in-spar ribs are aligned with corresponding coordination holes in said wing panel.

51. A determinantly assembled airplane wingbox as defined in claim 50, wherein:

said wing panels include wing skins and attached stringers, said stringers extending span-wise of said wingbox and lying between said ribs and said wing skins;

said stringers and said ribs have thickened pad-ups at locations at which said ribs intersect said stringers, said coordination holes extending through said pad-ups;

whereby said coordination holes provide enhanced certainty that said rib and said stringer pad-ups will vertically align within tolerance, enabling a reduction in area and weight of said pad-ups compared to conventional wings.

52. A determinantly assembled airplane wingbox as defined in claim 49, wherein:

said rib posts are positioned on said spars at certain positions and temporarily fastened thereon by temporary fasteners extending through aligned coordination holes in said rib posts and corresponding coordination holes in said spar webs, said certain positions existing in a digital model of said wing residing in said digital wing product definition.

53. A determinantly assembled airplane wingbox as defined in claim 52, wherein:

said rib posts are attached to said spar webs at said certain positions by permanent fasteners extending through fastener holes in said rib posts and said web;

said fastener holes in said rib posts and said web are drilled by said machine tool and said permanent fasteners are inserted and secured while said rib posts are temporarily secured in said certain position by said temporary fasteners extending through said aligned coordination holes.

54. A determinantly assembled airplane wingbox as defined in claim 53, wherein:

said temporary fasteners are replaced by additional ones of said permanent fasteners after said rib posts are secured permanently in said certain position by said permanent fasteners;

whereby said rib posts are positioned on said spar web with a high degree of accuracy within tolerances established by said digital wing product definition.

55. A determinantly assembled airplane wingbox as defined in claim 52, wherein:

said coordination holes in said rib posts and said spar webs drilled by at least one machine tool under control of at least one controller programmed with a program incorporating said digital wing product definition data that specifies locations of said coordination holes in said rib posts and said spar webs for aligning and positioning said rib posts on said spar webs at said certain positions specified in said digital wing product definition and achieved in said wingbox when said coordination holes in said rib posts are aligned with said corresponding coordination holes in said spar web.

56. A determinantly assembled airplane wingbox as defined in claim 46, further comprising:

a plurality of aileron hinge ribs attached to a rearmost one of said wing spars and projecting rearwardly therefrom;

said hinge ribs each having a distal end in which is mounted a hinge barrel, said hinge barrels being axially aligned with hinge barrels on other of said hinge ribs on an axis at a position and within engineering tolerances specified in said digital product definition;

said hinge ribs each having an attachment fitting fastened to said rearmost spar, said attachment fitting positioned on said rear spar by mounting said hinge barrel on a positioning pin accurately located in space to the rear of said rear spar at

a position specified by said digital wing product definition as the desired position for said hinge bushing in a distal end of said aileron hinge rib, and fastening said attachment fitting to said spar web at a position on said web which results in minimal movement of said hinge barrel when said locating pin in removed.

57. A determinantly assembled airplane wingbox as defined in claim 56, wherein:

said attachment fittings are attached to said spar web after attachment of said wing panels to said spar flanges;

whereby shifts in said positions of said hinge barrels as a result of distortion of said spar during fastening of said wing panel to said spar are minimized.

58. A determinantly assembled airplane wingbox comprising:

front and rear wing spars, each having an elongated upright web with upper and lower flanges;

upper and lower wing panels fastened to said flanges;

a plurality of aileron hinge ribs attached to said rear wing spar and projecting rearwardly therefrom;

said hinge ribs each having a hinge barrel axially aligned with hinge barrels on other of said hinge ribs on an axis within engineering tolerances at a position specified in a digital product definition established and maintained as an ultimate engineering authority for said wing;

said hinge ribs each having an attachment fitting fastened to said rear spar, said attachment fitting positioned on said rear spar by positioning said hinge barrel on a positioning pin accurately located in space to the rear of said rear spar at a position determined by a digital wing product definition as the desired position for said hinge bushing in a distal end of said aileron hinge rib, and placing said attachment fitting against said rear spar at a place thereon at which movement of said hinge barrel is minimal when said positioning pin is removed from said hinge barrel.

59. A determinantly assembled airplane wingbox as defined in claim 59, wherein:

said positioning pin is held in a machine tool under control of a controller programmed with a program incorporating data from said digital wing product definition;

said digital wing product definition specifies locations of said positioning pin for positioning said hinge barrels relative to said wing spar at positions specified in

said digital wing product definition when said hinge barrel is mounted on said positioning pin.

60. A determinantly assembled airplane wingbox as defined in claim 58, wherein:

said attachment fittings are attached to said spar web after attachment of said wing panels to said spar flanges;

whereby shifts in said positions of said hinge barrels as a result of distortion of said spar during fastening of said wing panel to said spar are minimized.

61. A determinantly assembled airplane wingbox as defined in claim 60, wherein:

attachment of said attachment fittings is by fasteners extending through fastener holes in said attachment fitting and through corresponding fastener holes back drilled through a stiffener attached to said wing spar using said attachment fitting fastener holes as drill guides.

62. A method of making an airplane wing, comprising:

supporting two airplane wing spars in chordwise spaced relationship on a supporting structure;

positioning a plurality of in-spar ribs between said spars by aligning coordination holes in opposite ends of said ribs with corresponding coordination holes in rib posts attached to said spars;

connecting said ribs to said spar rib posts to produce a wingbox frame

positioning upper and lower wing panels on said wingbox frame at certain positions by registering coordination features on said wing panels with corresponding coordination features on said wingbox frame;

fastening said wing panels to said wingbox frame at said certain positions by drilling fastener holes through said wing panels and said wingbox frame and inserting fasteners through said fastener holes, and securing said fasteners in said fastener holes.

63. A method of making an airplane wing as defined in claim 62, further comprising:

probing said two airplane wing spars on said supporting structure to establish accurate position information of said spars on said supporting structure; and

updating a part program in a machine tool controller with said accurate position information of said spars on said supporting structure, said part program

incorporating data from a digital wing product definition containing dimension and positioning information of said wing spars on said supporting structure.

64. A method of making an airplane wing as defined in claim 63, further comprising:

machining said corresponding coordination features on said wingbox frame with a machine tool programmed with said updated part program, said part program also incorporating data from said digital wing product definition containing dimension and positioning information of said wing panels relative to said wing spars and ribs, and containing location information of said corresponding coordination features on said wingbox frame;

whereby registration of said coordination features on said wing panels with corresponding coordination features on said wingbox frame indexes said wing panels on said wingbox frame to said certain positions as specified in said digital wing product definition.

65. A method of making an airplane wing as defined in claim 62, wherein said positioning step includes:

moving a portion of said supporting structure carrying one of said spars away from another portion of said supporting structure carrying the other spar;

drilling said corresponding coordination holes in said rib post on said other spar with a machine tool operated under control of a machine tool controller programmed with data from a digital wing product definition established and maintained as an ultimate engineering authority for said wing;

transporting said ribs to positions between said spars and temporarily supporting said ribs between said spars;

aligning said coordination holes in one end of said ribs with said corresponding coordination holes in said rib posts to position said ribs at a position specified in said digital wing product definition and fastening said one end of said ribs to said rib posts

66. A method of assembling a wingbox, in accordance with a design and within tolerances specified in a digital wing product definition, from major wingbox components including upper and lower wing panels, wing spars, and in-spar ribs, comprising:

locating and attaching one major wing component on a support fixture approximately at a position specified in a part program by positioning at least two

accurately machined coordination features in said one major wing component relative to corresponding reference surfaces projecting from said support fixture, said part program incorporating information from said digital wing product definition, including dimensional data and locations of features on said one major wing component;

probing said one major wing component with a probe to determine the actual position of said one major wing component on said support fixture;

updating said part program with said actual position of said one major wing component on said support fixture;

machining a first coordination feature in said one major wing component using a machine tool operated by a machine controller programmed with said updated part program;

positioning a second major wing component in contact with said one major wing component at a position specified by a digital wing product definition by aligning said first coordination feature in said one major wing component with a corresponding coordination feature in said second major wing component; and

fastening said second major wing component and said first major wing component together in said specified position.

67. A method of assembling a wingbox from major wingbox components as defined in claim 66, wherein:

said first major wing component is one of a pair of wing spars supported in chord-wise spaced relationship extending in a generally span-wise direction;

said second major wing component is an in-spar rib connected between said wing spars;

said first coordination feature in one of said spars includes a coordination hole drilled in a rib post fastened to said spar; and

said corresponding coordination feature in said in-spar rib is one of at least two coordination holes drilled in opposite ends of said rib and aligned with said rib post coordination hole for positioning said rib between said spars at said specified position.